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ABSTRACT

Every Kentucky school is expected to achieve the goal of proficiency on the state's Accountability Index by the year 2014. Many schools may not reach the proficiency goal in time without a broad, multifaceted approach to enhance educational outcomes. This study explored the possibility that expenditures for different purposes can become a policy took to elevate accountability gains. A three-level hierarchical linear modeling equation was devised. The first level consisted of 1999-2002 Kentucky Accountability Index scores for each school in the sample. The second level consisted of characteristics that differentiated the sample of 1,111 public schools. The third level comprised 170 school districts (out of 176) and consisted of characteristics differentiating the districts. The study found only one type of expenditure (central office support) that was directly associated with the accountability scores, and its effect was negative. Following the precedent of H. Wenglinsky (1997), three types of expenditures were shown to have indirect effects when mediated by the pupil-teacher ratio. Expenditures for instruction and instructional staff support revealed positive indirect effects, whereas central office support revealed a negative indirect effect (in addition to its negative direct effect). Although each of these effects were statistically significant, all were very small in magnitude. The findings suggest that school districts have only a limited ability to stimulate school performance with finance policy. (Contains 3 tables and 13 references.) (SLD)

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Running head: HOW EXPENDITURES AFFECT ACCOUNTABILITY SCORES

HOW EXPENDITURES AFFECT SCHOOL ACCOUNTABILITY SCORES: IMPLICATIONS FOR DISTRICT FINANCE POLICY

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Abstract

HOW EXPENDITURES AFFECT SCHOOL ACCOUNTABILITY SCORES: IMPLICATIONS FOR DISTRICT FINANCE POLICY

Every Kentucky public school is expected to achieve the goal of proficiency on the State's Accountability Index by the year 2014. Many schools may not reach the proficiency goal in time without a broad, multifaceted approach to enhance educational outcomes. The present study explored the possibility that expenditures for different purposes can become a policy tool to elevate accountability gains. The study found only one type of expenditure (central office support) that was directly associated with the accountability scores and its effect was negative. Following the precedent of Wenglinsky (1997), three types of expenditures were shown to have indirect effects when mediated by the pupil-teacher ratio. Expenditures for instruction and instructional staff support revealed positive indirect effects, whereas central office support revealed a negative indirect effect (in addition to its negative direct effect). Although each of these effects was statistically significant, all were very small in magnitude. The findings suggest that school districts have only a limited ability to stimulate school performance with finance policy.

Since the passage of the Kentucky Educational Reform Act of 1990 (KERA), Kentucky public schools have been placed under intense scrutiny. All public schools are enjoined to reach "proficiency" (100 out of 140 possible points) on the state's Accountability Index by the year 2014. The Accountability Index score of each school is calculated annually from a battery of academic tests and non-cognitive measures that denote student and school performance. At this point, twelve years into the reform era, only six of the state's more than 1,200 schools have reached the goal. With only twelve more years to go, it has become obvious that many, perhaps even a majority of the schools will not reach the proficiency standard without a broad, multifaceted approach to enhancing educational outcomes. Educators and policy makers face a daunting task.

Most educators and many policymakers assume a link exists between educational finance and educational performance, but the research that has attempted to support this assumption has been inconsistent at best. How expenditures affect student learning and the excellence of schools remains a hoary, unresolved problem for educational research. The present study plunges into the fray, asking how expenditures may influence school accountability scores. In Kentucky, finding the linkage between finance and performance would be of immediate value to policymakers. It would suggest ways in which to harness the education finance system to the purposes of KERA (cf. Ladd & Hansen, 1999).

Background

The presumed linkage between school finance and student achievement received its first major empirical challenge in the mid-1960's. *Equality of Educational Opportunity* (Coleman *et al.*, 1966), also known as the Coleman Report, found that school resources (expenditures and facilities) explained less than five percent of the variance in student achievement. Numerous studies followed attempting to confirm or to refute this finding. Hanushek (1989) performed a meta-analysis of school finance studies from 1967 to 1986, and confirmed the findings of the *EEO*. Hedges, Laine, and Greenwald (1994) reported a fresh meta-analysis and disputed Hanushek's findings. They concluded that school resources are systematically related to student achievement and these relations are large enough to be educationally important. Hanushek (1997) responded by updating and expanding his original meta-analysis, again finding little relation between achievement and expenditure. Meanwhile, Wenglinsky (1997) adopted a different approach hypothesizing that the effects of expenditures were largely indirect. His study concluded that expenditures influence achievement because they increase or lessen the pupil-teacher ratio. More recently, a RAND study (Grissmer *et al.*, 2000) that examined state-to-state improvement in NAEP test scores has found additional support for this perspective. Specifically, this study found that lowering the pupil-teacher ratio significantly increased achievement, while raising teacher salaries did not.

Despite the inconclusiveness of the research findings, state policy makers have taken inequities in school funding very seriously, as a spate of challenges to the constitutionality of unequal funding has swept across the nation. In Kentucky, the impetus for KERA was a class action suit that sought redress for school finance

inequities. A recent study by independent consultants (Picus, Odden, & Fermanich, 2001) has shown that substantial progress has been made since the advent of KERA to equalize educational funding across the state. But equal funding may not result in raising the performance of all students and schools for two primary reasons: First, as many educational researchers have concluded, school finance may not be the real issue here. Gamoran (2001), for example, commenting on the trend in many states to equalize school funding, asserts:

> This trend…will do little to reduce the major advantages held by those [students] from families with more economic resources over those with less. The most important resources tend to operate at the individual level, so they are unaffected by changes in the redistribution of collective funds for education (p. 143).

The second reason why the equalization of funding may not, in itself, elevate school performance is that how money is allocated for different purposes may be more important than how much money is available in total. Enhancing school performance may depend on how wisely school districts distribute the financial resources that they control. The present study will engage these issues by examining the effects of expenditures for different purposes on school accountability score gains.

The Present Study

In this study I sought empirically-supported answers for the following questions:

1. What are the effects of expenditures for different purposes on the change in Kentucky Accountability Index scores?
2. Are these effects direct, indirect, or both?
3. What are the policy implications?

Method

The evidence for the present study derives from using repeated-measures Hierarchical Linear Modeling (HLM) (Raudenbush and Bryk, 2002) to analyze the effects of different categories of expenditure while controlling for numerous school and school district characteristics. A three-level HLM equation was devised. The first level consisted of 1999–2002 Kentucky Accountability Index (AI) scores for each school in the sample. A two-year moving average was created from the accountability data. The second level consisted of characteristics that differentiated the sample of 1,111 Kentucky public schools. The third level comprised 170 of Kentucky's 176 school districts and consisted of characteristics differentiating those districts, including expenditures for instruction, instructional support, instructional staff support, district administration, school administration, and central office.

Variables

The variables used in this study and their descriptive statistics are shown in Table 1. Within-school repeated measures of the AI score were created from a moving two-year average across the four years of data. This resulted in three measurement points denoting the AI score in one-year increments. Each year of the Accountability Index was entered as a separate data record for each school, with the result that there were 3,333 cases in all—three cases for each of the 1,111 schools. The records for each school were denoted by the year, labeled in series (i.e., 1, 2, or 3). It should be noted that while the standard deviation of the Accountability Index is rather small relative to its mean, the range of scores (70 points) is quite substantial. Even more importantly, the mean is more than 30 points away from the proficiency goal of 100 points. To reach proficiency by

2014, the average school today will have to increase its accountability score by as much as three standard deviations. This is precisely why many schools may not achieve proficiency in time.

At the between-school level, variables that were included in the analysis consisted of the percent of students receiving subsidized lunch, the percent of African American students, school membership, the pupil-teacher ratio, and a series of dummy variables denoting school type. Two continuous variables—percent of African American students and school membership—were log transformed to achieve better approximation to a normal distribution. With regard to the multinomial school type, elementary school was designated to be the reference category. 'Combined school' refers to schools with grade levels that span either the elementary and middle school categories or the middle and high school categories. All of these variables described the school during 1999.

At the between-district level, a dummy variable was used to denote if the school district was an independent, rather than a county, district. A log-transformed measure of district membership was also included. Per pupil expenditures for instruction, instructional support, instructional staff support, district administration, school administration, and central office support were included as dollar amounts expended in 1999. Finally, a series of dummy variables were used to denote the geographic and demographic features of the county where the district was located. For more information on how this location index was constructed and its usefulness in exploring education outcomes in Kentucky, see Reeves (2000) and Price and Reeves (forthcoming).

Findings

The results of the repeated-measures HLM analysis are shown in Table 2. The first column of regression coefficients contains the fixed effects of the exogenous variables on the initial Accountability Index score. These results are not our primary concern, although brief mention will be made of them. Our primary concern is with the regression coefficients shown in the second column, the fixed effects of the exogenous variables on the annual change in the AI score. These are the effects that may promote or retard a school's progress toward proficiency.

The main thing to be gleaned from the first column of coefficients is that, with one very notable exception, none of the categories of expenditure is significantly associated with the initial AI score. The exception is expenditure for instruction, which is negatively associated with the initial AI score. This result, which appears counter-intuitive, can be explained by the fact that low scoring schools are recipients of Title I funds and other forms of categorical state and federal grants designed to enhance instruction. Far from contradicting the received wisdom, the results shown in the first column merely reinforce many previous studies that have found little association between the level of spending and educational achievement. A fault of many of these studies is that their examination of achievement was static; they did not examine gains over time.

The second column of coefficients, then, allows us to examine the effects of expenditure and other factors on the annual change in school performance. The intercept in the second column (i.e., the slope of the yearly change) indicated an average improvement of 1.88 points annually. District membership and two location categories exerted a significantly positive influence on the annual change. With respect to location,

it was in the more rurally located districts that schools held a slight edge to improve their performance. School membership, all the types of schools except for elementary, and pupil-teacher ratio each had a negative influence. Independent district, the percent of African American students in the school, and the percent receiving subsidized lunch did not register significant effects on the change in scores. The effects of expenditures were extremely small and non-significant for the most part. Only the expenditure for central office support was marginally significant, although the effect was still quite small. For example, reducing the expenditure for central office support by one standard deviation (about $52 per pupil) would result in an annual gain in the AI score of 0.16.

The pupil-teacher ratio had a small, yet quite significant, negative influence on the change in scores. This finding created the opportunity to explore potential indirect effects of expenditures on performance when mediated by pupil-teacher ratio. The rationale for exploring these indirect effects rested upon the earlier study by Wenglinsky (1997). To accomplish this I devised another HLM analysis—a two-level analysis this time—in which the first level consisted of the dependent variable, pupil-teacher ratio, plus controls for the types of schools. The type of school was found to have a large influence on the pupil-teacher ratio. The second level consisted of the expenditure variables. The results of this second HLM analysis are shown in Table 3.

In this model, the intercept estimated that the average pupil-teacher ratio at 22.5. Middle, high, and combined schools had substantially lower pupil-teacher ratios than elementary schools, despite the fact that elementary schools by law must have smaller classrooms. The reason for the seemingly anomalous finding, of course, was that secondary schools generally had many more specialized teaching faculty than did

elementary schools. In this model, too, several categories of expenditure were significantly associated with pupil-teacher ratio. Both instruction and instructional staff support were negatively related to the pupil-teacher ratio, although the size of the relation was weak. A considerably larger, positive relationship was found between expenditure for central office support and the pupil-teacher ratio. Coupling these findings with those obtained previously from modeling the direct effects on the AI score yields the following summary of effects:

One direct effect

Central office support —(-0.003)→ Change in scores

Three indirect effects

Instruction —(-0.002)→ Pupil-teacher ratio —(-0.058)→ Change in scores

Instructional staff support —(-0.004)→ Pupil-teacher ratio —(-0.058)→ Change in scores

Central office support —(+0.012)→ Pupil-teacher ratio —(-0.058)→ Change in scores

It is immediately apparent from the size of the path coefficients that the effects are small. Having said this, it is also apparent that expenditures for instruction and instructional staff support are positive in their influence. According to these results, if the expenditure for instruction were raised one standard deviation (i.e., $359 per pupil), the Accountability Index score would increase by 0.04. If the expenditure for instructional

staff support increased by one standard deviation (i.e., $ 102 per pupil), the AI score would increase by only 0.02. These results are clearly not large, hardly enough to be important for policy-making. Should we say the same for central office support? In this case, we should add the estimated direct and indirect effects, which are both negative, in order to get the total effect of this type of expenditure on the change in scores.

What would be the total effect of reducing the expenditure for central office support by an amount equal to one standard deviation (i.e., $52 per pupil)? The direct effect would increase the annual change in the score by 0.16, as noted above. The indirect effect would be to increase the AI score by 0.04. The total effect therefore would be 0.20. While the total effect of central office support is still small, it clearly outweighs the indirect effects of increasing the expenditures for instruction and instructional staff support. Furthermore, one can easily imagine an interaction where the savings from cutting back on central office expenditures could be allocated to enhance instruction and instructional staff support, all contributing to increased improvement of the accountability score.

Discussion

The results of this study show that allocations of expenditure for certain purposes do influence school accountability scores. Although one of the expenditure effects, central office support, has a direct component, other effects are indirect. Following Wenglinsky's (1997) precedent, I have shown that these indirect effects are mediated by the pupil-teacher ratio. The multivariate model used in this study contained a substantial number of variables that measured characteristics of the school and school district. The pupil-teacher ratio was one of the few variables to show a significant association with the

accountability score, although the effect size was small. The model predicted that a reduction in the pupil-teacher ratio of one would bring about a 0.06 increase in the accountability score; a reduction of five would bring about a 0.30 increase. Wenglinsky (1997) and Grissmer *et al.* (2000) also found that reducing the pupil-teacher ratio would have small, positive effects on achievement.

The many non-significant expenditure effects found in my study could be due to my use of multilevel analysis. Since expenditures were measured at the district level while the Accountability Index scores were measured at the school level, the effects of the expenditures were averaged across the schools within each district. If comprehensive and reliable data were available on school-level expenditures, it is might be possible to identify a greater number of significant expenditure effects, and the estimations would almost certainly be more precise. However, the collection of such data poses grave difficulties for researchers, not the least of these being resistance from school and district officials to release the information. Still, assembling school-level data may be the only way to find out truly how expenditures affect school accountability scores.

The present study used somewhat different data and a different methodology than a recent study by Roeder (2002), but our conclusions are similar. Roeder used multi-year data to explore if teaching and financial resources moderated the negative effects of poverty on school district accountability scores in Kentucky. He did not examine the change in accountability scores, but instead obtained year-by-year multiple regression results. Thus, his results are comparable to the first column of regression coefficients in my Table 2 above. Roeder found poverty to be the largest and most consistent factor affecting district performance. Teacher quality had a significant positive effect in two out

of five years; the effect was marginally significant in the remaining three years. Teacher salary was not significant in any year. Total per pupil revenue, his main measure of district-level funding, was not significant for any year. These and other findings led Roeder to conclude that policymakers should exercise caution when considering presumed linkages between resources and school performance.

Conclusions and Implications

The conclusions and implications of the present study are summarized in five basic points:

1. In general, the direct and indirect effects of expenditures on the gain in the Accountability Index were found to be nil or at most very small. Therefore, the ability of school districts to use finance policy to influence the gains in the Accountability Index scores appears quite limited.
2. Increasing expenditures for instruction and instructional staff support may have very slight, positive indirect effects, provided the additional monies are directed to reduce the pupil-teacher ratio.
3. Because the effect is both direct and indirect, reducing expenditures for the central office seems to be the most efficient finance strategy for improving accountability scores, but the anticipated effects are again very small.
4. The effects obtained in this study may be small because expenditures have been measured at the district level, whereas the Accountability Index scores were measured at the school level.
5. The possible influence of school-level fiscal strategies remains unknown, although anecdotal evidence from Kentucky schools suggests that reducing the

pupil-teacher ratio has made a difference in some cases. Collecting school-level finance data will be difficult and costly, but it is probably the only way to find out truly how expenditures affect school accountability scores.

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Table 1. Descriptive Statistics for the Variables Used in the Study.

Variable	*M*	*SD*	Min.	Max.
Within-school level (N_1 = 3333)				
Accountability Index	67.91	9.94	37.45	107.75
Year	2.00	0.82	1	3
Between-school level (N_2 = 1111):				
% students receiving free/reduced lunch	51.26	21.59	0.67	99.06
% Black students (ln)	-0.47	3.71	-6.91	4.29
School membership (ln)	6.09	0.56	4.17	7.63
Pupil/teacher ratio	20.43	5.20	9.40	42.10
School type:				
Elementary (reference category)	0.56	0.50	0	1
Middle	0.17	0.38	0	1
High	0.17	0.38	0	1
Combined	0.10	0.29	0	1
Between-district level (N_3 = 170):				
Independent district	0.31	0.46	0	1
District membership (ln)	7.74	0.91	5.27	11.47
Per pupil expenditures ($):				
Instruction	3182.27	359.33	2271.57	4635.24
Instructional support	180.56	57.17	49.61	388.39
Instructional staff support	237.37	101.51	28.48	923.82
District administration	272.95	159.58	39.14	933.96
School administration	278.32	66.30	128.93	511.84
Central office support	42.97	52.12	0.00	458.91
Location:				
Metro (reference category)	0.25	0.44	0	1
Nonmetro, adjacent to metro	0.24	0.43	0	1
Nonmetro, town < 2,500	0.17	0.38	0	1
Nonmetro, town 2,500 – 9,999	0.22	0.42	0	1
Nonmetro, town ≥ 10,000	0.11	0.32	0	1

Table 2. Results of the HLM Analysis: The Effects of Expenditures and Other Variables on the Initial Accountability Index Score and on the Annual Change in Scores.

Fixed Effect	**Initial Score**		**Change in Scores**	
	Coefficient	***SE***	***Coefficient***	***SE***
Intercept	68.659***	(1.720)	1.883***	(0.259)
District membership (ln)	-1.149	(1.011)	0.552**	(0.208)
Independent district	1.872	(2.142)	0.198	(0.276)
Nonmetro, town < 2,500	-5.784**	(2.098)	1.116**	(0.386)
Nonmetro, town 2,500 – 9,999	-3.271*	(1.485)	0.561*	(0.267)
Nonmetro, town ≥ 10,000	0.293	(1.845)	0.289	(0.225)
Adjacent to metro area	-0.471	(1.754)	0.102	(0.253)
Instruction	-0.004**	(0.002)	-0.000	(0.000)
Instructional support	-0.011	(0.010)	-0.001	(0.001)
Instructional staff support	0.007	(0.012)	0.001	(0.001)
District administration	-0.008	(0.006)	0.001	(0.001)
School administration	0.005	(0.010)	0.000	(0.002)
Central office support	-0.004	(0.010)	-0.003~	(0.002)
School membership (ln)	-0.598	(0.641)	-0.381*	(0.180)
Middle school	-3.581**	(1.205)	-0.877**	(0.262)
High school	-8.881***	(1.313)	-0.723*	(0.282)
Combined school	-3.741***	(0.998)	-0.554~	(0.293)
Pupil-teacher ratio	0.229**	(0.072)	-0.058**	(0.021)
% African American (ln)	-0.129	(0.125)	0.009	(0.040)
% free/reduced lunch	-0.353***	(0.055)	0.003	(0.008)

~p < .10; *p < .05; **p < .01; ***p < .001

Table 3. Results of the HLM Analysis: The Effects of Expenditures on the Pupil-Teacher Ratio, Controlling for School Type.

Fixed Effect	**Pupil-Teacher Ratio**	
	Coefficient	***SE***
Intercept	22.498***	(0.288)
Instruction	-0.002***	(0.000)
Instructional support	-0.004	(0.003)
Instructional staff support	-0.004*	(0.002)
District administration	-0.001	(0.001)
School administration	-0.002	(0.004)
Central office support	0.012**	(0.004)
Middle school	-7.099***	(0.306)
High school	-6.481***	(0.363)
Combined school	-4.879***	(0.365)

*p < .05; **p < .01; ***p< .001

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